of reaching the pericardium originally outlined by Larrey, followed by the removal of two inches of the seventh left costal cartilage, if necessary. Latham and Pendlebury[1] reported the successful performance of this operation with a vertical instead of an oblique incision and the removal also of two inches of the sixth costal cartilage, and Pendlebury[2] has operated upon two additional cases, one of which recovered.

Mintz[3] also has successfully drained the pericardium in the region recommended by Larrey.

There is, therefore, no doubt that aspiration through the left xiphicostal space has disclosed pericardial exudation which was not made evident by puncture elsewhere, and that successful drainage has been established through the same region. Consequently this route is to be recommended for exploratory aspiration, incision and drainage, since it gives ample room (by resection of the costal cartilage, if necessary), is free from risk to the pleura and peritoneum, and enables injury of the internal mammary vessels to be avoided or controlled. In critical cases when aspiration causes no outflow of fluid and the tip of the instrument can be moved about within the pericardium exploratory incision should speedily follow.

THE TREATMENT OF CHRONIC OBSTRUCTION IN THE LARYNX AND TRACHEA.[4]

By John Rogers, M.D.,
SURGEON TO GOUVERNEUR HOSPITAL, ASSISTANT SURGEON TO ST. FRANCIS HOSPITAL.

The causes of chronic obstruction in the larynx and upper trachea are generally classified as follows:

1. Cicatrices of traumatic, operative, or pathological origin. When following tracheotomy, the deformities may be due to (*a*) contraction of the posterior soft part of the trachea following separation of the anterior segments by the cannula; (*b*) dislocation of the cricoid forward and downward, especially when the fistula is through or close to it; (*c*) overriding of the cut anterior ends of the tracheal cartilages in too long a fistula; (*d*) inversion of the cut anterior ends of the tracheal rings, especially if the fistula is to one side of the median line; (*e*) contraction of the trachea around the cannula due to sloughing of the cartilages or rings; (*f*) spur formation posteriorly (as after enterostomy), especially in combination with contraction of the posterior soft portion of the trachea, or dis-

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[1] Lancet, 1903, vol. i. p. 798.
[2] Ibid., 1904, vol. ii. p. 1145.
[3] Centralbl. f. Chir., 1904, Bd. xxxi. p. 59.
[4] Read before the American Laryngological Association, Atlantic City, June 3, 1905.

location of the lower segment forward and the upper backward, or both.

2. Granulations around a cannula or intubation tube which are much less common than is generally believed. They have been described as occurring at the upper anterior angle of the fistula for a tracheal cannula, or opposite the usual fenestrum on the posterior tracheal wall, or at the lower end of the cannula or around its whole length, or about the upper or lower end of an intubation tube.

3. Hypertrophic subglottic laryngitis most commonly encountered in retained tube cases, less often in those with a retained tracheal cannula and almost always after diphtheria.

4. Prolonged and repeated diphtheritic inflammation, which must be exceedingly rare in these days of antitoxin, although it is worth noting that there is at least one case on record in which the exudate was demonstrable on the 151st day.

5. Postdiphtheritic paralysis of the laryngeal abductors, which is sometimes described and must be very rare, but clinically is indistinguishable from the following:

6. Atrophy of the laryngeal abductors from disuse in retained tube and tracheotomy cases.

7. Obturation or compression of the respiratory tract by neoplasms is common and involves first the removal of the tumor and next the treatment of any concomitant or resulting cicatricial stenosis.

Of these "chronic hypertrophic subglottic laryngitis" needs some discussion. It was described by Köhl[1] as one of the common causes for retention of the tracheal cannula after acute diphtheritic stenosis long before the days of intubation, but at present is generally regarded with suspicion or mistaken for "granulations" or a cicatrix. I had the correct diagnosis first forced upon me by undertaking laryngotomies to remove these supposed granulations or cicatrices in cases of retained tubes. The gross appearance was that of a general velvety thickening of all the soft parts within the thyroid and cricoid cartilages, which bled easily, though there was no ulceration. The vocal cords and ventricles showed only as a slight tumefaction or dimple, and when the divided thyroid alæ were brought in apposition the hypertrophied mucous membrane completely occluded the laryngeal lumen. The futility of operation in such a condition is obvious and to elucidate its pathology, as clinically at least, it is one of the commonest causes of retained intubation tubes, I must repeat in full the findings I have been able to collect.

I am indebted to Dr. F. Tilden Brown for the first specimen, that of a child intubated at the Willard Parker Hospital June 28, 1896. Autoextubation, followed by closure of the larynx within a few minutes, necessitated tracheotomy about a month later. A year subsequently, or on July 31, 1897, as the stenosis was unchanged, Dr. Brown inspected the larynx through a thyrotomy at the Presbyterian Hospital. There was an even thickening of the soft parts throughout the whole interior of the laryngeal cartilages. There was no sodden or watery appearance such as might be produced by œdema, but the thickened tissue seemed firm and vascular. Bleeding was easily excited by sponging. There was no sign of ulceration nor cicatrization, and the soft parts were apparently covered everywhere with epithelium. A vertical strip of tissue was then cut from the whole thickness of the soft parts on each side of the inner surface of the larynx. The pathologist of the hospital reported that these strips showed "infiltration with many small round cells, in places apparently granulation tissue. Over some thickened areas there is thin mucous membrane." It would be difficult to cut sections of such strips in a plane which would demonstrate the presence and integrity of the epithelium throughout, in other words; to prove by the microscope the absence of ulceration. But this may be inferred from the gross findings in spite of the use of the words "granulation tissue," which are intended to indicate a state of exudative and productive inflammation. This child died later of pneumonia.

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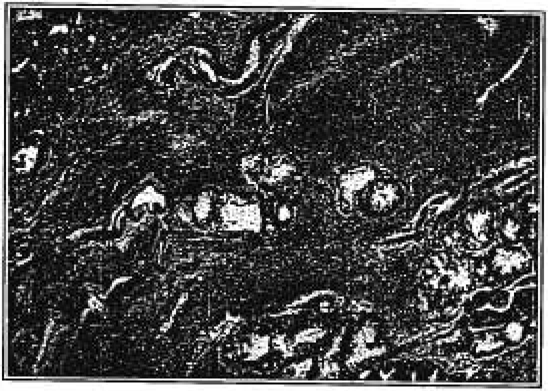
[1] Archiv f. klin. Chir., 1887, Band xxxv. pp. 75 und 403.

FIG. 1



The operation did not succeed in making respiration possible without the tracheal cannula.

I am indebted for the second case to Dr. Dillon Brown. This child was intubated by him for laryngeal diphtheria in the first week of February, 1897. The disease subsided, but the stenosis persisted and necessitated "retention" of the tube. Respiration without it was barely possible for about an hour, but no longer, and finally after autoextubation at the end of a month from the time of first insertion asphyxia occurred. At autopsy the intralaryngeal soft parts were found to be evenly thickened to such an extent that

FIG. 2

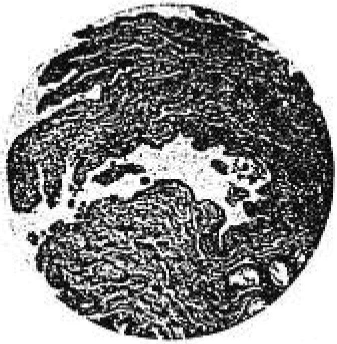
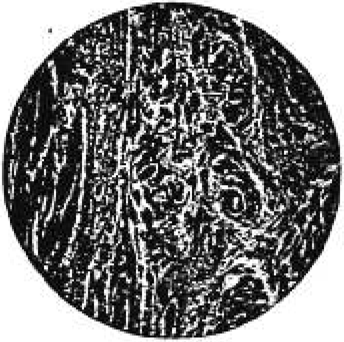


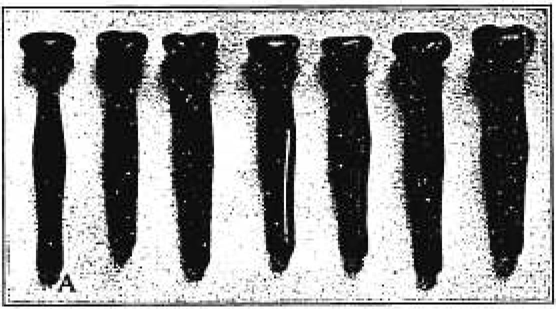
FIG. 3



the lateral portions of the larynx were in contact in the median line. The tissues were moderately soft and compressible enough to permit the introduction without undue force of the tube ordinarily employed for a child of this age and size.

Dr. W. N. Berkeley, the pathologist then in Dr. Brown's laboratory, cut some sections for me transversely through the centre of the larynx and made the following report: "The mucous membrane, submucosa, and remaining soft parts within the larynx appear much swollen and thickened by a growth of new cells. The vessels are numerous and congested. There is an irregular increase in the superficial epithelium and an hypertrophy of the subepithelial papillæ. There is no evidence of ulceration with loss of substance. The striated muscle fibres, both in front and behind the arytenoid cartilages, are present in the usual amount, but like all the other soft tissues, are infiltrated with columns of small round cells. In all probability this infiltration would interfere with or abolish the function of the muscles. The cartilage is normal."

FIG. 4

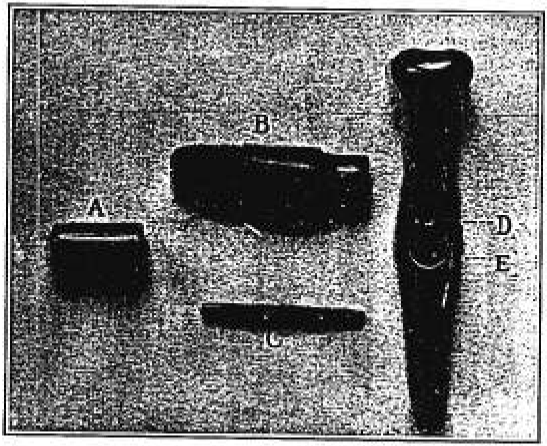


The third specimen is from Case VI. and is one approaching a cure. This child had worn an intubation tube for nearly three years and had never been tracheotomized. Only during the latter two months of tubage (and her life) was natural respiration possible for even a few hours.

The gross appearance was one of smooth, velvety thickening of all the soft parts within the laryngeal cartilages. This thickening reduced the lumen of the larynx to about one-third of its natural size. Within the anterior portion of the cricoid there was an irregularly circular area about one-quarter of an inch in diameter, which was evidently a cicatrix resulting from an ulcer, and another similar area an inch farther down and opposite the lower end of the tube in the anterior and lateral portions of the tracheal mucous membrane about one-half inch in diameter. These areas did not constrict the lumen of the larynx or trachea, but, on the contrary, seemed slightly depressed below the surrounding soft tissue. Ulceration had therefore occurred at these points and the healing had increased rather than decreased the lumen of the passage.

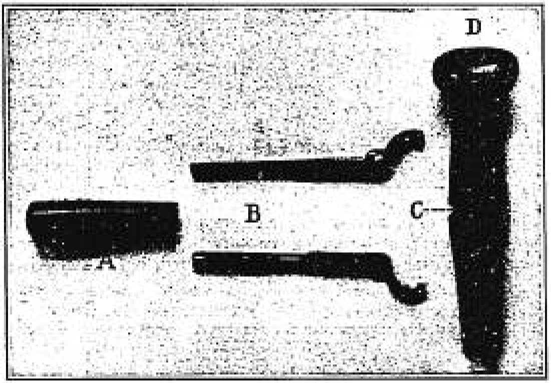
To make clear the explanation of the treatment proposed I must anticipate by stating that by a "normal" tube is meant one of the ordinary O'Dwyer instruments as originally made by George Ermold & Co. in seven sizes, usually distinguished as suitable respectively for a child one year old or younger—two, three, four to five, six to seven, eight to nine, and ten to twelve years of age. For adults the sizes run from one to ten inclusive. By "special" tube is meant one of the same length as the normal, but in which the neck or constricted portion just below the head or the part below the retaining swell is greater in the transverse diameter generally by $\frac{1}{32}$ inch or some multiple of this amount. The "retaining swell" or bulging central portion of the tube must at the same time have a transverse diameter at least $\frac{3}{32}$ inch greater than the neck or the tube will certainly be coughed out. In cases of hypertrophic laryngitis which are totally unable to breathe without a tube this difference is too slight and a difference of $\frac{4}{32}$ or even $\frac{5}{32}$ inch may be required. Life will often depend on this $\frac{1}{32}$ inch.

Fig. 5



By a "plugged" tube is meant one fitted with a plug made to screw accurately into a perforation in the anterior wall of a normal or special tube through a tracheal fistula. The plug is perforated at its inner end by a hole which exactly corresponds in size with the lumen of the tube. The plug is provided with a retaining pin, which, when the plug is in place, prevents it from rotating and so obstructing in the slightest way the lumen of the tube. By previous measurement the tube has a hole bored in its anterior wall, which when the tube is inserted lies opposite the tracheal fistula. Into this hole the plug is then screwed and "pinned" at right angles to the tube. A cap is then screwed down over the outer end of the plug to hold the pin in place. By a "clamped" tube is meant one fitted with a detachable pair of metal clamps made on the principle of an obstetric forceps. In the sides of the tube are cut grooves, which, when the instrument is in place, lie at the level of the tracheal fistula. Through this the clamps are made to grasp the tube and are then held in place by a collar screwed down around them until the collar touches the tube. The plugged or clamped tube is a guarantee against autoextubation and at the same time keeps the tracheal fistula from closing.

FIG. 6



The statistics of the 22 histories which could be submitted in full, did space permit, include 3 deaths, one from nephritis and pneumonia, 1 from autoextubation and asphyxia, 1 from asphyxia due to the clogging of a metal tube; 2 failures to cure; 7 still under observation. I do not consider a case cured until at least a year has elapsed after the last intubation without the appearance of any signs of stenosis. Of these 7 cases: 3 are able to breathe naturally for a few hours or days, although the obstruction when first seen was complete; 2 (adults) have been from one to three weeks without a tube, which was only reinserted when the laryngoscope showed evidence of beginning recontraction (these 5 are therefore still wearing tubes); 2 apparently cured, but the requisite year has not yet passed; 10 cured, that is, they have remained free from any obstruction for at least one year and some for four or five years. All of these have voices which range from perfect to hoarse.

FIG. 7

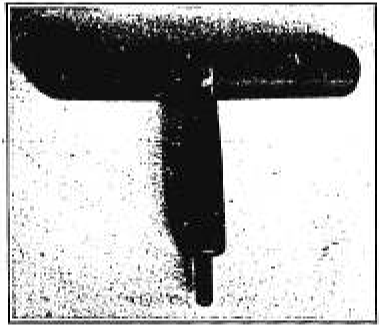
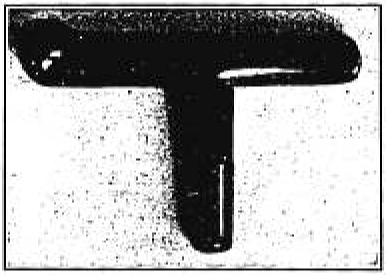


FIG. 8



CASE VI.[1]—*Stenosis due to hypertrophic laryngitis following intubation persisting unchanged for two and a half years; some improvement during the next six months with "special" rubber tubes; adductor spasm evident; more marked improvement with special metal tubes; death ultimately from nephritis and pneumonia.*

G. S., aged three years, was intubated for diphtheria at the Willard Parker Hospital in July, 1902. The stenosis persisted and the tube was worn continuously thereafter with frequent changes until February, 1904. On this date a special rubber tube, of the four to five length, was inserted, having the neck and retaining swell one-thirty-second of an inch larger in diameter than the normal measurement. During the change absolutely no air passed through the larynx, no bleeding was produced, and no force was required for intubation. The condition was therefore clinically one of chronic hypertrophic laryngitis. February 20th the tube was coughed out for the first time in her history and also for the first time in two years she breathed three days unassisted. Then the tube had to be reinserted on account of increasing dyspnœa. This comparatively slow recurrence of the stenosis often occurs during recovery. It is too rapid to prove an error in diagnosis or that the condition is cicatricial. February 28th a larger special rubber tube was inserted, and special tubes of increasing size were used with infrequent changing until July 8th. At this change, when the largest of the special tubes had been worn a month, the condition seemed as bad as ever, and acting under the belief that a spasm of the adductors of the larynx might have something to do with the difficulty a normal four-to-five tube was inserted until July 16th. On removing the last or normal tube I found the breathing, though somewhat difficult, was fairly good and hence the supposition that the obstruction at the last change was due to a cramp of the adductors and atrophy of the abductors seemed correct. I therefore returned to the special metal tube, which had produced the first improvement in March. July 27th this tube was removed and cleaned by the house surgeon, as it seemed to be foul and producing a cough. Respiration, though difficult, was possible. In August a nephritis developed and this was followed by a chronic pneumonia, which at autopsy was pronounced by the pathologist to be simple and not tuberculous. August 26th the tube was removed and natural respiration for the first time was easily possible, but the dyspnœa gradually returned and on August 29th the tube had to be replaced. The child continued to gradually lose ground and finally died from the pneumonia on September 12th. The tube was not removed until after death, but then the larynx appeared open enough for respiration to have been carried on unassisted. The report on the specimen will be found in the first part of this paper.

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[1] The twenty-two histories which it was the author's intention to submit in detail made this article so long that at the request of the editor only those are presented which give some idea of the worst difficulties and the method of treatment. In consequence these convey a more gloomy impression of the prognosis than is warranted by the majority of the histories.

CASE VII.—*Stenosis due to hypertrophic laryngitis following intubation for laryngeal diphtheria; complicated by cicatrices resulting from several laryngotomies and tracheotomies; obstruction from spasm of the adductors; also from granulations; cured by two and a half years of treatment with "special" tubage; duration of stenosis, six years.*

M. M. was admitted to the Willard Parker Hospital June 2, 1896, at the age of three years. She had been intubated six days previously for diphtheria. The stenosis persisted and on account of frequent and dangerous autoextubation she was tracheotomized July 13th. The stenosis still persisted and intubation was again tried. Astringents like alum applied on the outer surface of the tube to the laryngeal mucous membrane, as advised by Dr. O'Dwyer and afterward curetting the larynx through the mouth, were tried without success. In October, 1896, transferred to the Metropolitan Throat Hospital and thyrotomy performed by Dr. Wagner. Some thickened tissue removed from the interior of the larynx and the wound packed. Breathing through the tracheal cannula. The only pathological change noted during the operation appeared to be a general thickening and hypertrophy of all the intralaryngeal soft parts. In October, 1898, another thyrotomy, performed by Dr. Hope, with division and excision of numerous cicatrices. In January, 1900, the patient, then seven years old, was transferred to Gouverneur Hospital still breathing through a tracheal cannula. Under chloroform a much deformed larynx, which barely admitted one of the smallest urethral sounds, was dilated from below through the tracheal fistula with urethral sounds up to No. 25 F. There was a "spur" opposite the fistula and the entrance to the trachea below was contracted around the cannula; this was also dilated like the larynx. A ten-to-twelve normal intubation tube was then inserted and subsequently changed every four or five weeks for cleansing. In May, 1900, the tracheal fistula finally closed and so cut off all respiration except through the larynx and the stenosis was still marked. At this change I made several attempts at intubation and failed on account of the deformity and displacement of the larynx due to the numerous cicatrices. The consequent traumatism produced complete obstruction and asphyxia was barely avoided by a hasty tracheotomy, after which intubation was finally accomplished. In July, 1900, as a preliminary to changing the tube and to avoid the previous danger, I again punctured the trachea and then intubated without difficulty. This largest-sized tube was changed at intervals of four weeks without perceptible gain and therefore with the object of obtaining the utmost dilatation a "special" tube was employed of the same length as the normal but of much larger diameter. This was worn with the usual changes until January 15, 1901, when it was removed and a cure seemed at last obtained, but five days later at night there was a sudden attack of dyspnœa and the child was barely saved from asphyxia by another hasty tracheotomy by the house surgeon. Some infection followed with recontraction of the cicatrices, and not until March was intubation again practised. A little later dyspnœa began to reappear with the tube in place. An exploration revealed exuberant granulations at the base of the epiglottis overtopping the tube and blocking its lumen. In July another thyrotomy had to be performed to gain access to the obstruction and the granulations were then scraped and cut away. A normal tube with a small head to avoid pressure on the ulcerated surfaces was inserted at the close of the operation. This was worn until no more bleeding occurred at the periods for cleansing. In November the special tube with the large diameter was again used and worn with occasional removals for cleansing until February, 1902, when a cure seemed obtained, but that night there was a sudden attack of dyspnœa and another tracheotomy by the house surgeon. On the following day the large calibred special tube was reinserted and worn until May. Then a normal tube of the eight-to-nine size was substituted for two weeks, and in June the patient was at last dismissed cured. She has remained well and free from dyspnœa ever since and even has a good though husky voice. She is at present attending school (October, 1905).

CASE IX.—*Stenosis due to hypertrophic laryngitis following intubation for laryngeal diphtheria; thyrotomy followed by sloughing of the cartilages; permanent cure after three months of proper treatment.*

I. B., aged four years, admitted with diphtheria to Willard Parker Hospital and intubated in December, 1896. The stenosis persisted and necessitated retention of the tube. Frequent and dangerous autoextubation began, and to prevent asphyxia tracheotomy had to be performed on February 20th. A month later intubation with a normal four-to-five tube was practised with the tracheal cannula in place. No autoextubation occurred, so the cannula was removed and the fistula allowed to heal. The complete stenosis persisted and she was transferred to Gouverneur Hospital October 15, 1897. A week later the tube was coughed out and a hasty tracheotomy performed by the house surgeon. In November the cannula was removed and intubation again continued. January 10, 1898, as respiration was impossible without the tube, I explored the larynx by a median vertical incision through the thyroid and cricoid cartilages. The tissues were thickened and soft throughout the whole interior of the larynx, in which there were no ulcerations and no cicatrices. By bringing the parts together it was found that the hypertrophied mucous membrane completely occluded the lumen of the larynx. With the idea of producing a vertical cicatrix on each side of the larynx and so retracting the swollen parts I passed a silk suture through the cartilage and thickened mucous membrane on each side and tied it on the outer surface of the corresponding thyroid ala. This retracted the tissues sufficiently to allow easy breathing and the larynx was closed, but infection followed and in the course of the next few weeks apparently the greater part of the thyroid and cricoid cartilages sloughed out. April 20th the patient was discharged seemingly in a hopeless condition and condemned to the permanent use of a tracheal cannula. In August the patient returned with a dense cicatrice occupying the position of the larynx, but under chloroform with some difficulty a probe was passed from the tracheal fistula up into the mouth. This was followed with sounds of increasing calibre until the larynx and the entrance to the trachea had been dilated up to No. 24 F. A normal four-to-five tube was then inserted, the cannula removed and the fistula allowed to close. On October 1st the tube was removed and a six-to-seven normal tube substituted. The stenosis was still nearly complete. At the next change, in November, natural breathing was found possible and the tube was left out. For the first two weeks there were several attacks of inspiratory dyspnœa, especially at night, but under the administration of a little morphine these gradually disappeared. Since then the cure has remained permanent and the voice is fairly good.

CASE XV.—*Stenosis from cicatrices of syphilitic origin; clogging of a metal intubation tube; extreme subsequent contraction of the larynx which required laryngotomy to insert a plugged tube; apparent cure followed by apparent failure owing to unrecognized spasm of the adductors.*

C. McD., aged twenty-five years, was admitted to Gouverneur Hospital August 18, 1896, suffering from marked laryngeal dyspnœa, which had been increasing gradually since the previous April. There was an indistinct history of syphilis. She was immediately tracheotomized and, as is usual in emergency cases, the cricoid cartilage was divided. Subsequent examination revealed a larynx much deformed and obstructed by cicatrices. There was no ulceration. On November 15, 1898, under chloroform the larynx was dilated up to No. 35 F., with urethral sounds entered through the trachea and a metal tube inserted. Much difficulty in swallowing followed and a week later I arrived just in time to extract the tube, which had become nearly occluded by dried mucus. Another intubation was refused and the tracheal cannula had to be inserted. Attempts to use a Dupuis' segmented right-angled cannula failed, owing to the difficulty in swallowing and to the pain and swelling in the top of the larynx over the upper end of the superior half of the instrument. There was the same difficulty with an ordinary curved cannula, to which was fitted on its upper surface a bivalve dilating attachment to extend up into the larynx. Intermittent dilatation with Schroetter's tubes proved useless, as is usual in these bad cases. The patient left wearing a tracheal cannula. In February, 1899, she returned and under chloroform the larynx was found almost but not quite occluded. The thyroid and remains of the cricoid cartilage were then split in the median line upward from the cicatrix and the tortuous line of mucous membrane representing the remains of the lumen of the larynx was laboriously followed with a fine probe, as in external urethrotomy without a guide, until the pharynx was opened. A small adult intubation tube was then inserted through the mouth, and after making longitudinal incisions in the most prominent cicatrices the wound was sutured over the tube and a tracheal cannula placed in the lower angle beside the tube. A couple of weeks later an intubation tube with its anterior half cut away to receive the inner end of the cannula was attempted, but clogged with dried mucus and pus so often that it was abandoned and a "plugged" tube was substituted. This worked fairly well, but the fistula in healing came to be located about the middle of the thyroid cartilage. It, however, brought the tube near the surface and the patient could clean it daily with a feather after removing the plug. A change of the tube every four or five weeks demonstrated rapid improvement, and in May the tube was removed; the fistula in the neck contracted almost immediately, so that at the end of twenty-four hours it was practically closed. Meanwhile natural respiration was carried on without the slightest difficulty, but suddenly three or four days later, at night, an attack of dyspnœa almost caused asphyxia (adductor spasm), but fortunately enough of the fistula remained to enable the house surgeon to dilate it and insert the cannula. Further treatment was then refused for some time and the patient went home wearing the tracheal cannula. April, 1900, under chloroform, the contracted larynx and trachea were dilated as before. But so much difficulty in intubating was experienced on account of the "spur" which had formed in the posterior wall of the trachea opposite the fistula, that the attempt had to be postponed until a small right-angled blunt retractor, grooved on its convexity to fit the intubation tube, could be constructed. A week later, under chloroform, with this instrument in the lower angle of the fistula to drag the trachea forward and to guide the tube in the convexity of the retractor into it, intubation was accomplished. The tube used was one with a "plug" attachment. This was kept in place with occasional changes for cleansing for about four months or until August, 1900, then a cure seemed obtained, but two days later the fistula, having nearly closed, there was a sudden attack of dyspnœa as before at night and the cannula was reinserted and the patient refused further treatment. When seen last about a year later she was pregnant and showed signs of advanced pulmonary phthisis and has probably died since then, but at that time, though the cannula was still worn, laryngeal respiration, much to my surprise, was fairly good and another course of intubation would probably have produced a cure. But it seemed hardly justifiable in her condition. The apparent lack of success after prolonged dilatation was undoubtedly due to my failure to recognize and allow for the "cramp" of the laryngeal adductors. A tube with a small neck worn for a couple of weeks after the removal of the large ones would have permitted the abductors to regain their strength and so prevented the cramp or spasm of the adductors. She was a very nervous woman, somewhat addicted to beer and easily terrified, so that the sudden dyspnœa after apparent success would make her refuse trust in anything but the cannula. In the light of later experience I have regarded this case as really a success, though apparently a failure.

All the credit for the main principle in the management of chronic cicatricial laryngeal stenosis, that of long-continued dilatation with an intubation tube, of course belongs entirely to the late Dr. O'Dwyer. He long since insisted that this method was the only one generally applicable, and he published several cases of chronic stenosis due to one or another cause which were brought to a satisfactory conclusion by intubation continued for several months. But he had no regular course of procedure for curing the occasional cases of "retained tube" with chronic hypertrophic laryngitis, which in addition are often complicated by dangerous autoextubation, nor did he go into the details of the management of the various conditions accompanying stenosis with a retained tracheal cannula, and in these small particulars the histories of the cases given above supply much that is valuable. For there is no more serious disability than chronic respiratory obstruction in the upper air passages, and any method of treatment which is safe and offers a reasonable prospect of cure in nearly every instance should be welcome. Great patience, perseverance, and foresight with some technical skill are required, but given these my experience has led me to believe that a failure to ultimately restore natural respiration and even voice must be exceptional. Intermittent dilatation with Schroetter's instruments and all the various operative procedures which from time to time have been recommended chiefly in German literature are notoriously unsatisfactory. Some conditions must, however, occasionally be encountered which can only be remedied by plastic or other more or less extensive surgical interference, but they are rare and even then subsequent cicatricial contraction will probably arise. Primary union in the several laryngotomies mentioned above was much less common than suppuration, which may vary from simple failure of the wound to unite by first intention to extensive cellulitis of the neck with lymphadenitis and sloughing of the cartilages. In short, operations for stenosis of the larynx or upper trachea are seldom advisable except for the removal of tumors. Papillomata are probably the most common of these, and several cases have been reported in which intubation alone was said to have caused their disappearance. But without the definite knowledge of the extent of the disease only to be gained by a previous thyrotomy or tracheotomy intubation may prove dangerous; the papilloma or any other growth may be caught in the point of the tube and masses of this tissue pushed down ahead of it into the trachea like a gun wad. Several years ago I encountered a death from asphyxia in the practice of a colleague produced in this way. Hence, of course, intubation, like any other surgical procedure, cannot be indiscriminately employed, and an open operation, if only to make sure of the conditions, may sometimes be a necessary preliminary. But aside from the inspection or removal of new-growths the causes of stenosis rarely require anything beyond dilatation followed by intubation.

These cases can therefore generally be grouped as obstruction due to (*a*) cicatrices, (*b*) hypertrophic laryngitis, (*c*) granulations or œdematous ulcer, and (*d*) spasm of the adductors. One or more of these conditions may coexist and before proceeding to the treatment it is necessary to differentiate briefly the symptomatology. A cicatrix is easily recognizable by the history of a traumatism or disease with or without ulceration, coupled with inspection and instrumentation of the larynx, or tracheal fistula if one has been made. The deformities common after tracheotomy have already been described. The chief difficulty lies in differentiating between some of the tumors, including the granulomata and the persistent stenosis—hypertrophic laryngitis—sometimes following intubation for an acute condition, generally laryngeal diphtheria. The tumors, of course, if they cannot be removed through the mouth, require open operation any way, and exploration is generally safer than working in the dark. But the differentiation of a cicatrix from the other common conditions should be simple even when an open ulcer overlies it. In the first place it offers considerable resistance to instrumentation, and after dilatation or intubation the stenosis returns gradually within days or weeks. An hypertrophic laryngitis offers no resistance to the insertion of a tube, and after its withdrawal the recurrence of the obstruction is immediate and often complete. When these two difficulties occur together, as is not infrequent, especially after diphtheria, the history coupled with the resistance to instrumentation and the sudden recurrence of dyspnœa after it, should present no great difficulties, although any traumatism of the larynx may give rise to an œdema of quite sudden onset. The spasm of the adductors, though not strictly speaking a cause of chronic stenosis, so closely simulates clinically an hypertrophic laryngitis that it must be included in the differentiation. It seems to have been recognized long before the days of intubation and so must occur whenever the laryngeal muscles have been for any length of time at rest. Of course, when an intubation tube has been worn for a considerable period, particularly the "special" instrument which I recommend with an abnormally large neck, the abductors are put out of employment and must undergo an atrophy of disuse while the adductors are under some more or less constant tension with every attempt at coughing. However the explanation may be made, clinically at least there is no difference appreciable between spasm of the adductors and hypertrophic laryngitis after removing the intubation tube or plugging the tracheal fistula. When, however, this condition is suspected in a patient who has been intubated the diagnosis can sometimes at least be made by extubating under an anæsthetic. This removes the element of fright and abolishes the disturbances somewhat vaguely termed "reflexes," and normal respiration may be discovered where it might not otherwise be anticipated. Furthermore, a sudden spasm, and that, too, of very dangerous dyspnœa, generally occurring at night with coughing, and inspiratory rather than expiratory, can pretty safely be ascribed to this cause. The resistance encountered in this condition by the tip of an intubation tube catching on the closely approximated vocal cords should not be misinterpreted as a cicatrix, which takes time to develop and contract. The treatment of the two conditions is very different. "Granulations," if not perceptible to sight or touch, bleed easily upon instrumentation and generally occur as the result of the pressure or irritation of an intubation tube or cannula, in which they produce a more or less gradually increasing obstruction either to inspiration or expiration, seldom to both acts in succession. A spasmodic cough accompanied by more or less hemorrhage and dyspnœa may also give some indication of their presence; but I am convinced that they are a far less frequent cause of chronic obstruction than seems generally to be believed. When there is bleeding accompanied by stenosis following extubation or decannulization it is much more reasonable to ascribe the dyspnœa to a simple œdematous ulcer overlying an hypertrophic laryngitis or a cicatrix and not to exuberant granulations. The slight traumatism incident to the relief of the pressure of an intubation tube against such an ulcer or the "gagging" which often accompanies the removal of a cannula, especially if it is high up, can produce enough congestion in an eroded area to cause it almost immediately to nearly or quite occlude an already narrow space. I have never been able to positively verify such a condition but believe in its occurrence, and though it may be impossible to differentiate from a pure hypertrophic laryngitis, which is also very vascular and bleeds at the slightest touch, the treatment does not differ.

In a former article on this subject I recommended the long-continued use of as large a normal intubation tube as the larynx would admit, but experience has caused me to modify this treatment very materially for the different conditions. Simple chronic hypertrophic subglottic laryngitis is probably the most common cause of obstruction after intubation. This ought to read "after diphtheria," because it seems unfair to imply that it is due to intubation inasmuch as it was recognized as one of the most frequent obstacles to the removal of a tracheal cannula long before intubation was invented.[1] It may also occur entirely independently of any acute disease, and Case I. seems to be an example of this. There will, however, be considerable difficulty in convincing most intubators that unskilled or rough instrumentation does not have something to do with its inception or continuance, for a certain number of these cases will get well in the course of days or weeks with careful and frequent change of a tube, smaller if need be than the development of the patient would ordinarily indicate, the object being to minimize traumatism. Local astringents, as advised by Dr. O'Dwyer, applied to the interior of the larynx in a coating of gelatin or other substance adhering to the outer surface of the tube, may also succeed. But there are a number of cases (about 1 in every 100 intubated as estimated from the statistics given in my previous paper[2]) which will resist all these efforts for their relief. If the stenosis of this character has persisted for about a month in spite of all the usual plans of treatment, and spasm of the adductors can be excluded, another method must be adopted. Some of the patients will recover if as large a normal tube as can pass the cricoid cartilage is used for five to six months and changed at intervals only for cleansing. At the end of every four or five weeks the tube becomes foul and causes a bad odor in the breath and considerable cough. But usually in a persistent case it is better to start with a "special" tube or one having the neck one or more thirty-seconds of an inch larger in the transverse diameter than the normal instrument, with the object of applying pressure upon the thickened area within the larynx. As this area generally extends from above the vocal cords to or through the cricoid cartilage, and as the retaining swell of the tube must be enlarged with the "neck" to prevent autoextubation the retaining swell of the special tube must be enlarged along with the neck; and the same must be done with the head or there is danger of the instrument slipping below the epiglottis, which will then more or less completely occlude the upper aperture. Practically in these cases I am accustomed to make trials with normal tubes of increasing calibre under complete anæsthesia if necessary, until I have found the largest tube which will enter and pass through the larynx with some slight force. The "special" tube is then made of the length of the normal tube proper for the age and development of the patient, but with a retaining swell having the diameter of that of the trial tube. The neck must then be at least three-thirty-seconds of an inch smaller than the retaining swell and the head six-thirty-seconds of an inch larger than the retaining swell. If a metal tube is to be used its weight is better and more safely sustained by a head which is at least seven-thirty-seconds of an inch larger than the retaining swell and a large tube should have eight-thirty-seconds of an inch difference. If the child is under four or five years of age and so needs the smaller sized tubes the thirty-seconds of an inch difference should be altered to sixty-fourths of an inch. Moreover, a difference of three-thirty-seconds of an inch between the neck and retaining swell is the minimum difference which I have found by experience sufficient to keep the tube in place. Some patients will require four-thirty-seconds or even five-thirty-seconds of an inch difference. In the first part of the treatment of an hypertrophic laryngitis, especially if the stenosis is complete, as is frequently the case, it is wise to start with a special tube having a diameter of the neck five-thirty-seconds of an inch less than that of the retaining swell. Care in these seemingly minute details may mean all the difference between life and death, as unexpected autoextubation or aspiration of the tube into the trachea (impossible with the normal tube) can easily be fatal accidents. After a special tube thus carefully made has been worn a month or six weeks it usually must be changed and cleaned or the accumulation on it may cause it to clog suddenly, or produce ulceration, or a septic bronchitis, or pneumonia. Another tube should be at hand of one-sixty-fourth or one-thirty-second of an inch larger diameter through the neck and retaining swell than the last. Some slight improvement in the stenosis can generally thus be detected in the resistance offered to intubation if it is not clinically apparent. The judgment of the operator must determine the amount of presure which can be borne without sloughing. Fortunately the larynx seems capable of bearing much more traumatism in these chronic conditions than one would think possible, and if some little ulceration occurs as it often must, the epithelium will in course of time cover the raw area unless the pressure is extreme. Furthermore this ulcerative process, if not too extensive, may actually be the way in which cure takes place in these cases of simple hypertrophic laryngitis. Scattered areas of fibrous cicatricial tissue may in contracting against the cartilages do away with the preceding chronic exudative and productive inflammation. A most important question in these and to a less extent in cases having another etiology lies in the use of metal or vulcanized rubber tubes. The metal instrument is usually made of bronze or some less expensive compound heavily gold plated. At any rate it is composed of two different metals, the exposed part being gold. In two or three of the cases of hypertrophic laryngitis described above absolutely no progress could be made after weeks or months of treatment with hard rubber tubes so constructed as to make all the pressure the larynx seemed able to bear. Then after the substitution for the special rubber tube of a similar or slightly smaller compound metal tube, either a cure or very marked improvement was found at the next change or within four or five weeks. I am unable to explain this fact except on the theory of some electrolytic action. The metal instrument is far heavier than the rubber and the pressure may have something to do with its advantages, but I doubt it, as I know I have made more pressure with a large rubber than with any metal tube and there must be some other reason for the difference. The claims for electrolysis are generally regarded with suspicion, but these metal tubes, after being worn a month or two, become heavily coated wherever they press most upon the larynx, that is chiefly around the head and neck, with a stony, calcareous deposit, and under and around this the gold plating entirely disappears. There is of course no acid or alkali in the body which can dissolve gold, and it does not chip off but apparently dissolves. The external calcareous deposit of course roughens the surface, and if the tube is worn for a long time may reach such proportions as to prove a very serious obstacle in extraction. I once met with such a case in the practice of a colleague in which the tube, having been in place for several months, required for removal general anæsthesia and a strong pair of forceps to permit a firm grasp of the head of the tube. The metal tube will, however, if so constructed as to exert moderate pressure upon all the thickened tissue of an hypertrophic laryngitis, sooner or later produce a cure. But the patient who wears one must be constantly watched, as it has a tendency to clog and thus asphyxiated one of my cases and very nearly did the same with another (Case XV.), and naturally after those experiences I have always been afraid of these tubes and only resort to them when the special hard-rubber instrument after thorough trial in increasing sizes proves a failure.

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[1] Köhl. Archiv. of klin. Chir., 1887, Band xxxv. p. 75.

[2] Annals of Surgery, May, 1905.

Autoextubation is a frequent and very dangerous complication in any intubated case, but especially dangerous in hypertrophic laryngitis and introduces the "special," or normal "clamped," or "plugged" tubes. Some patients will cough out any tube which has not such a mechanical attachment to keep it in place, and as autoextubation is most common with hypertrophic laryngitis, I have come to believe that some degree of this condition is, if not the primary, at least the secondary cause of the difficulty. The chronically inflamed tissues are irritable and their contact with the tube excites coughing accompanied by retching or involuntary expulsive contraction of the pharynx. The combination of an attempt to cough and vomit at the same time seems the surest way for the patient to get rid of the tube, and life generally depends on its immediate reinsertion or a hasty tracheotomy. The latter operation probably, by giving rest to the larynx, seems occasionally to produce a cure, but ordinarily it only adds a cicatrix and a possible tracheal deformity to an already bad-enough condition. If there were no other way to escape the dangers of autoextubation it might be justifiable, but hypertrophic laryngitis used to be one of the most frequent obstacles to decannulization and it seems hardly proper to inflict a tracheal fistula for its cure. Still, the tube must be kept in the larynx and for this purpose I offer the "clamped" or "plugged" instrument. If autoextubation is at all frequent the trachea is carefully opened in the median line through the second and third rings and the intubation tube while in position marked to correspond with the incision, or if a tracheal fistula has already been made the tube is inserted and marked at a point coinciding with the fistula. During the few succeeding days required to make the instrument the cannula will have to be worn, but this inflicts the least possible damage. Some explanation is required as to the comparative advantages of a "clamped" or "plugged" tube and as to the use of such an instrument in general. It is assumed that the trachea is opened carefully in the median line well below the cricoid, and only enough to comfortably admit the cannula and subsequently the retaining attachment for the tube. Deviations from these rules as indicated previously promote cicatrices and tracheal deformities. If the fistula is already existent when the patient comes for treatment, as is frequently the case, there is of course nothing to be gained and much may be lost by enlarging or altering the position of the fistula, and it is then only a question of a normal or "clamped" intubation tube. The self-retaining instrument is far preferable to a tracheal cannula, to which it is the only alternative in hypertrophic laryngitis complicated by frequent and dangerous autoextubation if only because it places the patient in a practically normal condition with the single exception of a whispering voice. For less serious cases of stenosis, especially those which experience has demonstrated can breathe for an hour or two without mechanical assistance, the self-retaining tube may be thought to possess doubtful advantages. But in these there are many factors to be considered. To be sure at least one of the patients in this series could not swallow while wearing the instrument, but that experience is very exceptional, and in adults, especially "nervous" subjects, equally common with the normal tube. That the clamp or plug may act like the cannula in promoting or maintaining a tracheal deformity or favor a necrosis of cartilage has always been my fear, and hence I never use it except in cases of necessity; but experience seems to show that no ill effects are to be anticipated, and hence I have no hesitation in recommending it whenever there is the least anxiety as to autoextubation or subsequent adductor spasm. In my earlier cases, owing to unwarranted suspicion of the self-retaining tube, I believe I have taken great and improper risks in using the "special" tubes, although they are less unsightly and more ideal in effect. The perpetuation of the fistula by the "plug" also offers the distinct advantage of a sense of security in adults who are relieved of the dread of autoextubation, and in case of clogging of the tube can remove the plug and cleanse the interior of the instrument by simply poking a feather through the opening. Indeed I was first forced to employ this kind of tube in Case XV.; the normal (metal) tube previously used became obstructed one day quite unexpectedly and so nearly produced asphyxia that a substitute arrangement seemed imperative. This woman thereafter cleansed her tube in the way suggested every morning and never again had difficulty.

After removal of any tube, particularly a large or special one which has been worn a long time, there is great danger of sudden adductor spasm and strangulation and an opening in the trachea already present is a great safeguard. The spasm, however, usually occurs some days or hours after the removal of the tube (and plug), and the "fistula," when not kept patent artificially, is apt to nearly or quite close before this dangerous incident. The usual curved cannula, which could be employed in the interim, is manifestly improper, as it drags the lower segment of trachea forward and pushes the upper back, and therefore I recommend a perfectly straight cannula so fitted to its shield that it can be pushed in or pulled out and thus stay with its inner extremity protruding into the lumen of the trachea. The diameter of the straight cannula should not be over one-eighth or one-quarter of an inch to avoid undue separation of the tracheal rings and approximation of their unsupported posterior extremities, and at the same time it must be large enough to permit, if need be, the insertion of a tracheal dilator through the fistula it maintains. This straight cannula only need be worn for the first two weeks after removal of the intubation tube. Subsequently to this period I have never met with an adductor spasm, and any other obstruction occurs slowly and can be met by reintubation.

The plugged tube cannot be made in small sizes, as either the plug or the tube or both must be constructed of vulcanized rubber, and there is a limit to the strength of this material. The plug and tube cannot both be made of metal, as the calcareous deposit which always takes place on the surface of a metal tube is very hard and firmly attached and might easily prevent the removal of the plug if the latter were likewise made of metal. The workmanship must also be of the best and very exact, because the least irregularity in correspondence between the lumen of the plug when screwed in place and that of the tube will cause rapid clogging. Possibly a metal tube with a hard-rubber plug is the best combination for cheapness, strength, and durability, and as the retaining rod and cap are also of metal it offers possibilities for attempts at electrolysis for those who believe in such treatment. The "clamped" tube is the only one I have found capable of construction in the small sizes for children under ten years, and it is very useful. The tube has to be grooved on its outer surface to smoothly and exactly receive the clamp, as any irregularities or roughness will produce ulceration. The tube must be of rubber and the clamp preferably of silver, as a metal tube and a metal clamp would speedily become inseparable on account of the calcareous deposit previously mentioned. Also a clamp fashioned like an obstetric forceps is much better than one having the blades pinned together as in a pair of ice tongs. The disarticulated blades, though somewhat difficult to insert in a squirming, frightened child, will enter a very small hole and also there is no pin to break and drop into the trachea. The "cap" of metal then screws down snugly on the tube over the shanks of the clamp and should leave no rough or irregular interval to produce irritation.

The treatment of the adductor spasm, which is particularly to be dreaded after using large or "special" tubes for the cure of an hypertrophic laryngitis, has been partly outlined in the advice given as to maintaining the patency of a tracheal fistula. It is dangerous and must always be watched for after any prolonged intubation; as it is apparently due to an atrophy of disuse in the abductors a small tube which permits them to functionate and at the same time maintain respiration is a logical procedure. After determining, if necessary, with the aid of anæsthesia that the hypertrophic condition has subsided a normal tube of the size proper for the age and development of the child is inserted and left for about one or two weeks. During this period and for a week longer assistance must be constantly near at hand in case of autoextubation. If, however, a clamped tube has been used and the small straight cannula retained in the fistula the danger is very slight. The nurse or any attendant, should difficulty occur, can readily push the straight cannula or a curved one for that matter into the trachea. The straight cannula is apt to slip outside the cartilaginous rings, especially when worn with an intubation tube. A curved cannula, by the way, inserted alongside the tube or into a fenestrum in its anterior wall, I have found to be an utter failure.

A *cicatricial* stenosis, particularly if a hasty tracheotomy has at some earlier stage been performed, is often complicated by a contracted trachea with a spur opposite the fistula; and if there has been a tracheotomy for the autoextubation following laryngeal diphtheria, there is in addition probably more or less hypertrophic laryngitis. But even when there is a history or probability of considerable loss of cartilage (see Cases VII., IX., and XV.) and contraction of the larynx until the lumen seems practically obliterated (Case XV.), experience has shown me that the prognosis is still good. In the milder cases without a tracheal fistula insertion of a normal hard-rubber intubation tube for from one to six months will invariably effect a cure. Cocaine is a sufficient anæsthetic, and if the resistance to a tube of the proper size seems too great a smaller one can be employed for a few days and then a larger substituted. In the tighter and more deforming strictures general anæsthesia is required to permit the necessary preliminary dilatation. The bad strictures always have had a tracheotomy at some earlier period or need it urgently when first seen, and the fistula serves admirably for the introduction of urethral sounds which are excellently adapted for the purpose. Beginning then with the smallest size, which will pass through the contracted area, others are passed in rapid succession until the intubation tube can be inserted. Some judgment must of course be used to avoid the possibly fatal accident of making a laceration which may extend into the pharynx or œsophagus, but though I have done the operation many times and used very considerable force I have never encountered this or any ill results. Nevertheless the possibility of its happening must not be overlooked. Occasionally, as in Case XV., the stricture may be so tight or tortuous that its lumen may have to be opened by a careful dissection like a strictured urethra, but as long as any traces of mucous membrane are left and a tube can be passed from the pharynx into the trachea over or through the remains of the epithelium, there can be good hopes of a cure. Even very extensive loss of cartilage, as in Case IX., may be repaired, although Dr. O'Dwyer[1] cites one instance in which as the result of diphtheria the whole cricoid had sloughed out and this he considered irremediable except by tracheotomy. I should not, however, be inclined to condemn such a case without a trial.

In addition to the stricture, which is generally worse above the fistula, there will always be one at and just below this point, especially if the cannula has been worn long, and this also must be dilated like the one above. Then when inserting the tube the spur opposite such an old fistula in the posterior tracheal wall will be a serious obstacle to pass unless a small right-angled blunt retractor or hook, grooved on its convexity to receive and guide the entering tube downward and backward, is placed in the lower angle of the fistula, dragging the inferior tracheal segment forward. In adults I have several times had to exert all the force possible in two fingers pushing down from above on the head of the tube while counterpressure was made externally on the larynx with the other hand to pass this point with its spur.

The comparative advantages of using a normal, a special, or a "clamped" or "plugged" tube in these cases have already been discussed. As a rule a combination of a plugged with the principle of a special tube is the best. The plug is a safeguard against clogging and autoextubation and maintains the fistula as a subsequent escape from the difficulty of adductor spasm; the feature which for brevity I have called "special" in the instrument means an enlargement of some portion of the diameter over the corresponding diameter of the normal tube to exert a dilating pressure upon some particular part of the larynx or trachea. The normal tube is long, as it was designed by Dr. O'Dwyer to pass as deeply as possible into the trachea beyond any diphtheritic process. Its lower end is constricted from side to side to pass harmlessly through the glottis, the retaining swell is as large as will pass easily through the ring of the average cricoid, and from this point upward the tube is again flattened from side to side to fit the larynx. The "special" tube must always have the retaining swell, and this can be larger than the normal, as a diphtheritic swelling within the cricoid and consequent sloughing from traumatism at this point need not be considered; but at its neck or its lower end its diameter must be increased to stretch the stricture to be combated up to the largest possible normal lumen of the air passages. No exact measurement for this can be given, and they can only be approximately estimated and by a trial of different tubes. If, for example, the stricture is in the trachea at the lower end of the cannula (rare, though I have seen one case at the Willard Parker Hospital), the tube from the retaining swell down must be of the same diameter throughout and long enough to pass the contracted area. Again, if there is an hypertrophic laryngitis complicating a cicatrix the tube must have the diameter of its neck increased, although (unless it is a clamped or plugged tube) the transverse diameter of the retaining swell must always exceed that of the neck by three-thirty-seconds or preferably four-thirty-seconds of an inch.

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[1] American Surgery, May, 1900.

A rough estimation of normal measurements which I have found useful is obtained by comparison with the patient's index finger, which is somewhere near the calibre of his trachea below the cricoid. The length of this finger is also about the distance from the suprasternal notch to the tracheal bifurcation.

The prognosis of a cicatricial stricture is difficult to give.. Some cases seem to recover permanently after a few weeks or months of continued dilatation; others, especially those in which the rules for a proper tracheotomy have not been or could not be carried out, will relapse from time to time and prove very discouraging.

In a few instances I have attempted to dissect out all cicatricial tissue and, by accurate suture of the trachea and overlying soft parts over a well-fitting tube, to obtain primary union and so do away with these annoying and dangerous relapses. But the results have not been encouraging, possibly because asepsis is practically impossible. In Case XI., although the wound united throughout by first intention, the stricture was again evident within a few days after the removal of the tube. In the others infection took place and the wound broke down in whole or in part. On the other hand, persistence in the dilatation for months or years (Case VII.) has seemed finally to yield a permanent cure, and hence in general cicatricial strictures of the larynx or trachea should be continuously maintained for at least six months. An attempt may then be made to do without the tube (with proper regard to adductor spasm), and at the end of a week the larynx and trachea tested for recontraction by insertion of the tube last worn. If none is apparent the test should be repeated once every one or two weeks for a month or more. At the first sign of recontraction the tube should be inserted and worn for another six months and then again tested.

But if the stricture is once allowed to contract seriously beware of attempting to intubate without preparations for tracheotomy. Such a recurrent stricture, especially if near a previous tracheal fistula, is apt to be very tight before it causes distress and very resistant to tubage. It is wisest to first attempt a passage with the Schroetter dilators, and if these fail do another careful tracheotomy in the old cicatrix when present and then dilate again with urethral sounds followed by intubation, as at first. Perhaps the safest rule after a cure seems obtained in these cases is intubation for a week every couple of months or oftener if required for several years or until no tendency to contraction can be detected during a considerable period. A pure hypertrophic laryngitis is, if anything, more difficult to handle than the cicatricial form of obstruction, as there is no time to think in the interval of changing the tube—generally for weeks or months the obstruction remains complete and the clean tube has to be immediately reinserted and it takes longer to cure the condition. But after it is once well I have never met with any recurrences of the stenosis. The average duration of treatment has been from about six months to a year, although one case recovered permanently within four weeks and another, complicated by numerous cicatrices to be sure, required nearly three years before natural breathing was finally obtained. This very long period was, however, largely due to my inexperience at that time.

Granulations as a cause of chronic obstruction are, I am convinced, rare, and when present are fortunately easily handled. Their removal, like any other new-growth, by cauterization, excision, or curettage is of course the first step and this can generally be accomplished through the mouth or tracheal fistula, although the latter may have to be enlarged to provide access. To prevent recurrence sources of irritation must be eradicated by making a new fistula or by changing the shape or length of the tube.

Granulations are most common at the base of the epiglottis around the head of the intubation tube, and Dr. O'Dwyer describes two cases in which they were finally overcome in this situation by so building up and remodelling the head of the instrument as to distribute the pressure it exerted over a larger area. In Case IX. the difficulty was satisfactorily met by using a smaller than normal tube. The principle of course is to remove the traumatism, or at least minimize it, and thus the details for individual instances can be readily adjusted.

A word as to feeding may be necessary. For the first few days after intubation liquids only are permissible and they should be taken in the Casselberry position with the mouth lower than the pharynx and it lower than the œsophagus. But it is surprising how quickly these patients learn to swallow a varied diet naturally and how few abnormalities they display. Even if an intubation tube should have to be worn permanently this is far preferable to the alternative of a tracheal cannula.

EMPYEMA OF THE FRONTAL SINUS.[1]

By Richard H. Johnston, M.D.,
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The case I report illustrates so well the so-called closed empyema of the frontal sinus and certain peculiar phases of the disease that I have thought it might prove of interest. By closed empyema I mean that at no time could a discharge of pus into the nose through the frontonasal canal be detected. Though several careful examinations were made from time to time, this most important symptom of disease of the accessory cavities of the nose did not appear. The history of the case is as follows: The patient is now thirty years of age. He had most of the diseases incident to childhood, and since then has been healthy until the beginning of his present illness. His parents are living at advanced ages, and are healthy. In January, 1904, he had what he considered a mild case of "grip." He felt weak and languid and was forced to lounge about his room for two or three days. After this indisposition he convalesced rapidly, and was soon able to resume business. About two weeks later he was taken with a severe pain over the left eye. The pain recurred regularly every other day, and was peculiar in that it would begin at twelve o'clock noon, or between the hours of 12 and 4 P.M. If it did not appear before five o'clock in the afternoon the patient had nothing to fear until the next day. Occasionally the pain would miss the alternate day, but was sure to come the third day. On Sunday, if the patient remained perfectly quiet, the attack would be postponed until Monday, but if he took a walk or exercised in any way he was sure to suffer. The duration of the pain was always five or six hours. In the beginning of the trouble he suffered at times—usually in the morning—from dizziness or, to use his own words, he felt as if he were under the influence of liquor. The attacks always began in the left temporal region, with a feeling of numbness, and gradually extended toward the middle

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[1] Read before the Medical and Chirurgical Faculty of Maryland, April 26, 1905.